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Tissue specificity of certain plant hemagglutinins (Lectins)

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Lectins were isolated from the seeds of jack fruit, Nerium and Bengal gram. The lectin from Bengal gram caused agglutination of erythrocytes of human A, B and O blood groups whereas the lectin from jack fruit reacted with erythroytes of A group and neuraminidase treated O group erythrocytes. Lectin from Nerium was able to agglutinate A group blood cells and rabbit RBCs. These lectins were also tested for tissue specificity. Jack fruit lectin was specific to epithelial cells of tongue, intestine and blood vessels while Bengal gram lectin was nonspecific. The high specificity of Nerium is under investigation.

It is well known that lectins, a class of plant proteins, have specific carbohydrate binding properties. Early studies on human blood groups using lectins were carried out by Renkonen[1], Boyd and Reguera[2] and Bird[3]. Recently the interest on plant lectins attained more significance due to the finding that they can bind specifically to certain tissues of the body. Peanut lectin binds specifically to immature thymocytes[4] and germinal centres of mouse lymphoid tissue[5]. Mouse leukemia cells are very well agglutinated by wheat germ agglutinin[6]. The difference in the affinity of lectins to bind with different types of cells is due to the differences in the surface components of cells. The important land mark in the field of lectins is the finding that the two toxic lectins Abrin and Ricin present in the seeds of **Abrus precatorius** and **Ricinus communis** respectively can inhibit protein synthesis in intact cells[7]. The lectin Modeccin isolated from the roots of the plant Adenia digitate is very toxic and inhibit protein biosynthesis[8]. The toxicity of diphtheria toxin for the human lymphoblastoid cells was shown to be increased by covalent linkage with anti human lymphocyte globulin. Recently Edwards **et al**[9] showed the improved ability of an anti mouse lymphocyte globulin to suppress immune response of mice to sheep red blood cells by conjugating it with Abrin. Because of these interesting results, the present study is aimed to isolate, purify and find out the specificity of few lectins as the plants are found abundently in Kerala.

Material and Methods

The seeds of the following plants which are commonly found all over Kerala were selected for this study:

1) Jack fruit (Atrocarpus integrafolia)
2) Bengal gram (Cicer arietinum)
3) Nerium (Thevetia nerifoli)

The lectins were separated by ammonium sulfate precipitation and purified by sephadex G-200. The separation was carried out at or below 4°C. Hemagglutination tests were carried out by using pre washed human (A,B and O groups), ox, sheep and rabbit erythrocytes. For testing the tissue specificity, the lectins were conjugated with activated horse radish peroxidase. The conjugate was purified and then allowed to act on the tissues and finally stained with Diamino benzidine (DAB)[10]. In some interesting cases, protein bound hexoses were estimated by the method of Weiner and Moshin[11].

Results and Discussion

The Bengal gram lectin was found to be effective in agglutinating human A,B and O group erythrocytes. The lectins from jack fruit agglutinated only A group erythrocytes and neuraminidase treated O group erythrocytes.

Since Nerium is a toxic plant more attention was given to the lectin from its seeds. It is found to be specific in agglutinating human A group erythrocytes and rabbit erythrocytes. Sheep and ox erythrocytes were not agglutinated.

Tissue specificity of these lectins were studied by the pattern of DAB staining on spleen, tongue, liver, kidney and small intestine of mice. Bengal gram lectin was non-specific and attached to all types of cells of these tissues whereas jack fruit lectin was specific to epithelial cells of tongue, intestine and blood vessels. The lectin from Nerium was highly specific to mast cells of tongue. This lectin is found to be a glycoprotein which contains about 12% of protein bound hexoses.

The tissue specificity of many lectins have been studied in detail by many workers[4,5]. The toxicity of Abrin and Ricin were reported to be due to its capacity to inhibit protein biosynthesis[7]. The specificity and toxicity of the lectins aroused the interest of many cancer research workers [12 13].

The most important drawback in cancer chemotherapy is the non specificity and toxicity of the drugs used. A high concentration of drug is used for cytotoxic effect and it destroys the cancer cell as well as the normal cells. At the same time the lectins are specific and only a smaller concentration is required for toxic effect. Molten et al[14] showed that cytotoxicity of antibody against SV40 could be increased several folds by coupling it with diphtheria toxin. The increased toxicity is due to the imparted specificity. Thus once we are able to find out toxins specific to each type of cells, they can be coupled with antibody or antitumor drugs. It will increase the effectivity of treatment and reduce the toxicity. Nerium seems to be a good choice and further work is in progress.

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